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## A New Species of Whiptailed Lizard (Genus *Cnemidophorus*) from New Mexico

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The species of *Cnemidophorus* herein described was found in 1947 while we were engaged in making an ecological and herpetological survey in Socorro County, New Mexico, for the U. S. Atomic Energy Commission. Observations were made during the subsequent years of this survey, 1948-1950, and, in the company of Kenneth S. Norris of Los Angeles, we gathered additional herpetological material from many parts of the state of New Mexico. In addition, field work which has concerned study of *Cnemidophorus* either specifically or incidentally has been carried on by us for several years in all the states of the southwestern desert region and in adjacent Mexico.

Perhaps there is no genus of lizard occurring in North America today that has been studied and continues to be studied with as much uncertainty and confusion as *Cnemidophorus*. Thus it is not to be unexpected that the announcement of a new species of whiptail within the United States should be viewed, at first, with some apprehension. Unfortunately, the systematics of *Cnemidophorus* have been most extensively worked out in the laboratory rather than in the field and the various results speak for themselves. A knowledge of the appearance in life, and the ecology of the various forms, is now more than just a desirable requisite to any attempt to deal with these lizards systematically.

In addition to comparing its characteristics with those of the remaining species in the *sexlineatus* group, we have made comparative studies of the new species with all forms occurring sympatrically with it over its known range and which have been collected and studied in the field by us. Species distinctness is fully demonstrated for the entity here described with regard to

relationships with the known geographically confluent and possibly confusable forms, *C. sackii* and *C. inornatus*. All three entities in question have been observed in sympatric contact; each maintaining, with no detectable gene exchange, its own genetically controlled and marked differentiation.

*Cnemidophorus neomexicanus* sp. nov.

*Type Specimen.* Number 55807, Museum of Vertebrate Zoology, University of California, Berkeley. Collected August 2, 1947, at McDonald Ranch Headquarters, 4800 feet elevation, 8.7 miles west and 22.8 miles south of New Bingham Post Office, Socorro County, New Mexico, by Charles H. Lowe, Jr. Preserved August 2, 1947, in alcohol. The type has two additional labels as follows: 4588 University of California, Los Angeles; 3528 C. H. Lowe, Jr. (Plate 1).

In 1945, the McDonald Ranch Headquarters was made into the base camp for local operations of the U. S. Atomic Energy Commission. The same camp was in government operation and used by us as our base camp in 1947.

*Diagnosis.* A medium sized and distinctive species in the *sexlineatus* group characterized by (1) seven well defined longitudinal light stripes on the body; (2) a single longitudinal row of small, diffuse, and light-colored spots in each of two dorsolateral and two upper lateral dark fields; (3) absence of spots in the lower lateral and the narrow paravertebral fields; (4) a blue tail; (5) a row of circumorbital semicircle scales which is unusually extensive anteriorly, usually separating the third and often the second supraocular scale from the frontal; (6) postantibrachials not abruptly nor markedly enlarged; (7) pre-nasal not in contact with first supralabial; (8)  $74.9 \pm 0.62$  scales around mid-body (excepting the enlarged ventrals); (9)  $184.3 \pm 1.2$  scales from occiput to rump; (10)  $10.2 \pm 0.28$  scales between the paravertebral light stripes anteriorly.

*C. neomexicanus* is distinguished from the remaining species in the *sexlineatus* group as follows:<sup>1</sup>

From *C. burti* by (1) seven longitudinal light stripes on body; (2) light stripes distinctly less, rather than distinctly more, than half the width of the intervening dark fields; (3) no loss or significant reduction of spots in adults; (4) ground color not reddish-brown; (5) fewer scales around midbody.

From *C. gadovi* by (1) small and non-abruptly enlarged postantibrachials; (2) anterior nasal not in contact with the second supralabial; (3) anterior extension of the circumorbital semicircle series of scales.

<sup>1</sup>Additional evidence is necessary to verify *C. burti*, *C. gadovi*, and *C. labialis* as species.

From *C. labialis* by (1) seven longitudinal light stripes on body; (2) light spots in the dark fields; (3) anterior nasal not in contact with the second supralabial; (4) three preanal scales; (5) greater number of femoral pores.

From *C. sexlineatus* by (1) anteriad extension of the circumorbital scale series; (2) seven well defined longitudinal light body stripes; (3) light spots in the dark fields.

From *C. sackii stictogrammus*<sup>2</sup>, with which it is sympatric, by (1) smaller body size; (2) seven light colored longitudinal body stripes including a vertebral stripe; (3) light colored spots in the dark fields larger, less numerous, less clear in outline and in a single longitudinal row; (4) darker ground color of upper surfaces; (5) blue tail; (6) anteriad extension of the circumorbital semicircle scale series; (7) smaller scales, as shown by significantly greater number of scale rows around midbody and significantly greater number of rows from occiput to rump; (8) significantly greater number of scales separating the paravertebral light lines at midbody; (9) non-abruptly enlarged postantebrachial scales and less abruptly enlarged mesoptychial scales.

From *C. sackii innotatus*, which it may meet in central New Mexico, by (1) light spots in the dark fields; (2) anteriad extension of the circumorbital scale series; (3) wavy or serrate nature of the vertebral stripe.

From the sympatric population of *C. inornatus* (*perplexus* auct.) by (1) larger body size; (2) light spots in the dark fields; (3) less blue color on the ventral and other surfaces; (4) significantly greater number of scale rows from occiput to rump and around midbody; (5) anteriad extension of circumorbital scale series.

*Description of type specimen (measurements and colors from the freshly killed specimen).* Adult female, snout-vent length 64.7 mm., tail length 144.6 mm., right hind leg 51.2 mm. to tip of fourth toe nail. Transverse scale rows (measured on the midline from occiput to rump) number 185; longitudinal scale rows (measured around midbody on lateral and dorsal surfaces, excluding ventral plates) number 72; longitudinal scale rows on base of tail directly posterior to postanal small scale area 25; preanals 3; femoral pores 18/18.

<sup>2</sup>All mention of *C. sackii stictogrammus* in this report has reference to this form as it occurs in the general confines of Socorro County, New Mexico; for, as presently delimited (Burger, W. L., 1950, Chicago Acad. Sci., Nat. Hist. Misc., no. 65), *C. s. stictogrammus* includes several different and as yet unnamed racial entities. Moreover, *C. sackii innotatus* Burger appears *not* to be conspecific with *C. sackii*.

The small circumorbital semicircle series of scales completely borders the third supraocular mesially on both sides and contacts the second supra-ocular; in addition, it nearly completely borders the second supraocular mesially on the left side; five scales of the series border the two central supra-oculars (numbers two and three) on the left side and four scales border these on the right side (Fig. 1).

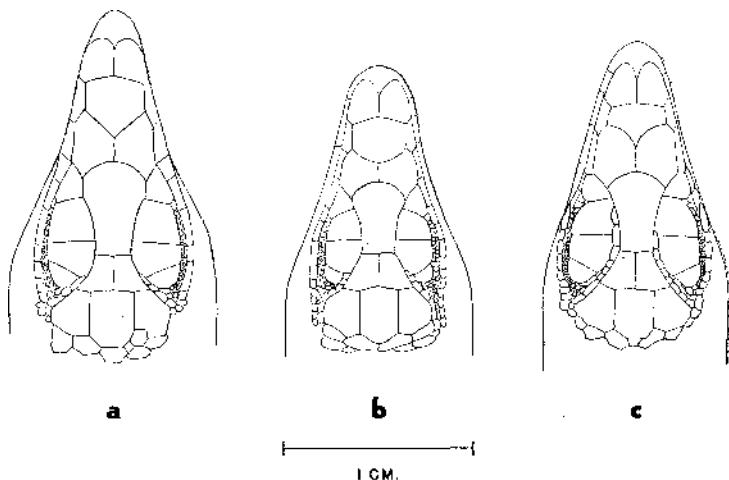


Figure 1. Dorsal views of heads of the three species of the *sexlineatus* group of *Cnemidophorus* occurring in Socorro County, New Mexico. Left to right: *C. sackii stictogrammus*; *C. inornatus*; *C. neomexicanus*. Note particularly the relative development of the circum-orbital semicircle series of scales in the three species.

General head scalation is that usual for the *sexlineatus* group: 3 parietals (including interparietal), 2 frontoparietals, 4 supraoculars, five enlarged occipitals in the primary (outer) row, one frontal, two prefrontals, two nasals, postnasals 1/1, loreals 1/1, preoculars 1/1, suboculars 3/3. On the left side a small scale (frenocular) is split off of the loreal and is bordered by the fourth supralabial below, by the preocular above and by the anteriormost (first) sub-ocular posteriorly. Supralabials 6/6, designating posteriormost as the first in contact with the posteriormost subocular; infralabials 7/7, with posteriormost under and at least partly "covered" by the posteriormost supralabial. A mental and postmental; chinshields 6/6.

Mesoptychials are in relatively uniformly enlarged rows, neither abruptly differentiated from, nor grading well into, the granular scales of the posterior gular fold (mesoptychial fold). Mesoptychial scales in the body mid-line are slightly smaller than laterally adjacent scales of the same row. Postantebrachials are not conspicuously enlarged, but grade gradually into the smaller surrounding scales.

The ground color of both paravertebral body fields is black and grades to lighter colors laterally, being dark brown in the dorsolateral fields and brown in the lateral fields<sup>3</sup>. The dorsal surface of the head is olive brown, lightening to grayish brown at the tip of the snout; laterally it is brown. The upper surfaces of the hind legs are blackish-brown and irregularly and boldly mottled with cream color; the upper surfaces of the front legs and feet are slightly lighter in color and less boldly marked than the hind legs and feet, and like the latter are mottled with cream color. The distal three fourths of the upper surface of the tail is light grayish-blue, to light greenish blue, being most blue colored on the dorsal surface proper; the proximal upper surface of the tail is brown, grading gradually into the distal blue. The lower one-half of the lateral surface of the tail is lighter in color than the upper half. On the proximal quarter of the tail there is a faint continuation of the bold body pattern of light stripes alternating with dark fields; all the primary stripes of the body are more or less well represented on the proximal quarter of the tail with the exception of the vertebral stripe which ends at the first enlarged tail whorl, a point approximately over the anus. The body stripes continued onto the tail are faint pinkish-brown rather than yellowish brown. The brown fields of the tail are pinkish-brown. The keels of the scales of the dark fields on the tail are black to blackish-brown and thus produce thin dark lines on the anterior one-quarter to one-sixth of the tail.

There are *seven* complete, distinct, and unbroken light longitudinal stripes on the body. Each paravertebral, and the vertebral stripe, while varying in color from yellowish brown anteriorly to duller yellowish brown at the extreme posterior, is only very slightly more yellowish anteriorly. These three dorsal stripes are deeper yellowish brown than those laterally which become progressively lighter in color; the lowest lateral stripe is light grayish-brown. At its anterior end at the occipital scales, the vertebral stripe breaks into two separate, small, and bilaterally symmetrically placed dots. While being as clearly defined as the others, the vertebral stripe is unique in having

<sup>3</sup>Color names used in this description have no reference to any particular standardized system of color nomenclature.

a faint but noticeable serrate appearance. The paravertebral stripes continue anteriorly unbroken onto the occipital scales and faintly over the parietals to the posterior margin of the posterior supraocular. The dorsolateral stripes continue anteriorly over the upper edge of the eye to above its anterior corner. The main lateral body stripes continue anteriorly over the upper margin of the external ear opening, on below the eye and faintly across the snout above the supralabials. An additional very short stripe runs below the main lateral body stripe from the upper insertion of the foreleg to the external ear opening; thus in addition to the seven primary body stripes there are two, less distinct, and short, lateral neck stripes.

Spots occur in the dorsolateral and upper lateral fields. The spots are light yellowish brown like the stripes; they are separate or rarely in contact, not markedly distinct in their diffuse outline, and are small—averaging slightly less than one millimeter in diameter. With rare deviation, the spots are arranged as single longitudinal rows symmetrically placed in the center of the dark field. The following number of spots occurs in the dark fields: left dorsolateral field 13; right dorsolateral field 12; left upper lateral 14, right upper lateral 13; left lower lateral 0; right lower lateral 0; both paravertebral fields 0. Spots in the lateral fields begin anteriorly in the shoulder area over the insertion of the forelimb. Spots in the dorsolateral fields begin anteriorly just posterior to the forelimb insertion. Spots do not occur in the neck region nor in the body field continuations onto the tail.

The ventral surfaces of the head, body and legs are immaculate faint blue with a faint iridescent pinkish tinge. The outer ventral plate rows are darker grayish-pink. The granular scales of the primary gular fold are light gray. The ventral surface of the tail is bluish, being on its proximal half approximately the same faint blue as the abdomen and grading to progressively darker blue (light blue) on the distal half.

The iris is bright green with the pupil margined by a thin ring of yellow orange.

*Variation and ontogenetic change.* While changes in ontogeny affecting color pattern follow certain fundamental trends that are common to many other species of *Cnemidophorus*, such changes in *C. neomexicanus* are not so marked as to cause confusion in identity at any stage of ontogeny in this species, as they do in others. The major progressive changes in color pattern with age in *C. neomexicanus* involve the following (Table 1): (1) lightening of the initial black body ground color; (2) fading of the initial bright blue tail color; (3) fading of the initial brighter yellow stripe colors; (4) obscuring of spots, which are brighter yellow and of clearer outline initially. Of impor-



tance is the fact that in this species there is *no significant change* in the number of light spots in the dark fields during ontogeny.

Table 1. Color pattern characteristics, in life, of a hatchling (August, 1950) and an adult *C. neomexicanus* from the type locality in Socorro County, New Mexico.\*

Characteristic	Juvenile S-V Length 39 mm.	Adult (Male) S-V Length 70 mm.
Head, dorsal surface	Pl. 15, H6	Pl. 15, H5
Head and body, ventral surfaces	Pale blue, markedly tinged with iridescent pink	Pale blue, faintly tinged with iridescent pink
Tail, distal portion		
dorsal surface	Pl. 25, L6	Pl. 36, B5
ventral surface	Pl. 25, K1	
Light stripes, on anterior body		
paravertebrals	Pl. 18	Pl. 10, J3
dorsolaterals	Pl. 18	Pl. 10, G2
laterals	Pl. 9, F2	Pl. 9, B1
Light stripes on proximal portion of tail	distinctive	obscure
Dark fields at midbody		
paravertebrals	black	black
dorsolaterals	black	blackish-brown
upper laterals	blackish-brown	brown
lower laterals	lighter blackish-brown	lighter brown
Light spots in dark fields		
<i>character</i>	distinct in outline, clear cream color	obscure in outline, dull yellowish brown
<i>number</i>		
L paravertebral field	0	0
R paravertebral	0	0
L dorsolateral	12	13
R dorsolateral	13	12
L upper lateral	15	18
R upper lateral	17	16
L lower lateral	0	0
R lower lateral	0	0

\*Color determinations (Pl., etc.) from Maerz and Paul, "A Dictionary of Color," McGraw-Hill Co., 1930.

Individual variation is slight. For the most part, the description of the type serves well for the species. Minor variation in both color pattern and scalation is notable, however. As stated above, spotting is almost entirely

restricted to four fields. Occasionally one or two spots may occur in the lower lateral field. Variation in number of spots is slight; Table 2 presents such variation for five adults selected at random, comparing *C. neomexicanus* with the sympatric *C. sackii stictogrammus*.

In occasional individuals the vertebral stripe is slightly broken and/or is quite serrate in appearance, but it has never been observed to be faded or obscured. There is occasional variation in the paravertebral stripe at its anteriormost point—usually, either dots or a very short Y occurs. Very slight variation in the degree of blueness of the tail and of the ventral surfaces and feet of animals of the same age group is noticeable. The degree of blueness *never* equals that of the sympatric *C. inornatus*.

Variation in scalation, like that in color pattern, is not marked. While three suboculars are always present, an additional small scale (frenocular) occasionally occurs, split off from the posterior part of the loreal and bordered by the fourth supralabial below, by the preocular above, and by the anterior-most (first) subocular posteriorly. The degree of completeness of the circumorbital semicircles along the mesial edge of the posterior three supraoculars (numbers 2, 3 and 4) ranges from complete to approximately three-fourths complete. The third and fourth supraoculars are completely bordered and often the second as well. Mesoptychials are normally not reduced in the ventral midline as they are in the type. The prenasal is never in contact with the first supralabial. The enlarged preanals number three.

Scale rows around midbody exclusive of the eight rows of enlarged ventrals number 71-80 ( $74.9 \pm 0.62$ ). Scales from occiput to rump 178-198 (184.3

1.16). Scales between paravertebral light stripes 7-13 ( $10.2 \pm 0.28$ ). Femoral pores 17-21 ( $18.3 \pm 0.18$ ). Average adult body size (S-V length) approximately 70 mm.; maximum S-V in hypodigm (48) 76.4 mm., a female.

*Material.* In addition to the type, 47 paratypes (both alive and preserved) have been available and studied. Due to governmental restriction, the type locality of *Cnemidophorus neomexicanus* may be inaccessible to collectors for some time. For this reason paratypes have been distributed to the following institutions: Museum of Vertebrate Zoology, University of California; Department of Zoology, University of California, Los Angeles; Department of Zoology, University of Arizona; Department of Zoology, University of Illinois; American Museum of Natural History; United States National Museum.

*Distribution and locality records.* In addition to the type locality, *C. neomexicanus* has been collected by us at five other localities, all in Socorro Coun-

ty, New Mexico. These are listed below in order of increasing distance from the type locality: 2.5 miles west of North Oscuro Peak; 7.0 miles west of Socorro; 7.2 miles west of Socorro; Socorro; 4 miles east of Bernardo. In Figure 2 (map), the three localities of Socorro and vicinity are represented by a single dot, the westernmost. The type locality is represented by the southernmost dot.

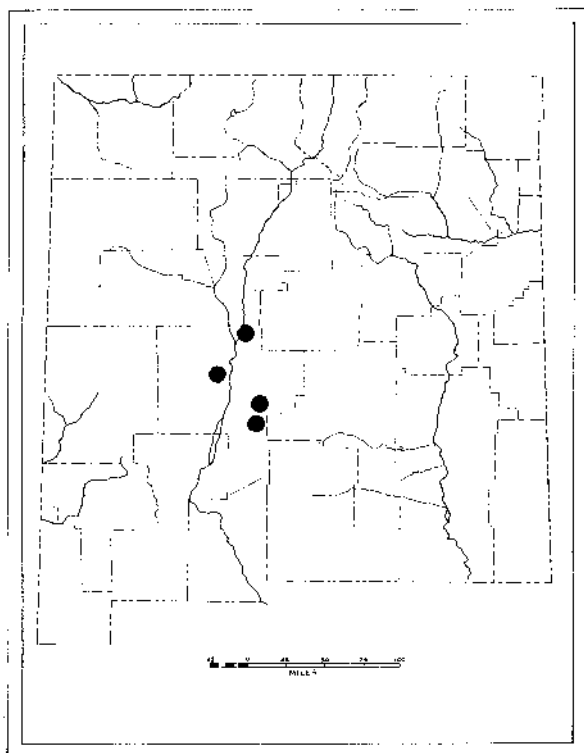


Figure 2. Distribution of *Cnemidophorus neomexicanus* in New Mexico based upon specimens examined.

Gadow mentioned two specimens in the British Museum from Bernalillo County, New Mexico, which possessed seven complete light stripes, the central being zig-zag, and light spots in the first and second fields<sup>4</sup>. This des-

<sup>4</sup>Gadow, H., 1906, Proc. Zool. Soc. London, p. 369. Since going to press, two additional specimens from new localities have become available. A specimen from 6 mi. south of Bernalillo, 5500 ft., Sandoval County, verifies the occurrence of the species in this area as indicated by Gadow's description. The second, MVZ 23295 from South Boundry, White Sands National Monument, 4000 ft., Otero County, is the southernmost known locality. *C. neomexicanus* is to be expected in Texas and Chihuahua.

**PLATE I**

a. *Cnemidophorus neomexicanus*, type specimen.

b. *Cnemidophorus inornatus*, Socorro County, New Mexico.

c. *Cnemidophorus sackii stictogrammus*, Socorro County, New Mexico.

d. Type locality of *Cnemidophorus neomexicanus*, 8.7 miles west and 22.8 miles south of New Bingham P. O., Socorro County, New Mexico. Photo looks westward from the point of collection of the type specimen on the *Atriplex canescens*-*Sporobolus airoides* playa.

e. Looking eastward from the type locality of *C. neomexicanus* towards the San Andreas Mountains, with *Yucca-Ephedra*-grassland on the western lower alluvial slope. While *Yucca* data-grassland perhaps best connotes the general vegetation, *Ephedra trifurca* is of spotty occurrence. Note the relatively large size attained by the individual of *Ephedra* at right center; at this locality it is rarely found as well developed as shown.



cription fits *C. neomexicanus* and could apply to no other species in that area. Bernalillo County is the first north of Socorro County.

*Comparisons.* At the type locality, all New Mexican species of *Cnemidophorus* (as presently understood) are sympatric. It was primarily on account of this circumstance that the probable specific distinctness of *C. neomexicanus* was immediately recognized when first collected. The sympatric species in question are five: *C. tigris* (= *tesselatus*) and *C. tessellatus* (= *grahamii*) of the *tes-selatus* group; *C. inornatus* (= *perplexus*), *C. sackii* (= *gularis*) and *C. neomexicanus* of the *sexlineatus* group. *C. neomexicanus* is in the *sexlineatus* group of boldly striped whiptails and will not be confused with the species of barred and tessellated patterns comprising the *tesselatus* group.

Once its characteristics are understood, *C. neomexicanus* can be confused with none of its sympatric congeners and is so clearly distinct that it can readily be recognized in the field. As stated above, its total color pattern immediately distinguishes it from either *C. tigris* or *C. tessellatus*. Marks aiding in the field discrimination between *C. neomexicanus* and *C. sackii stictogrammus* are the larger size of *sackii*, its lack of a vertebral stripe, more numerous and distinct spots in the dark fields (Table 2), and its tan, pinkish, or greenish-brown, rather than blue, tail. Field marks aiding the immediate differentiation of *C. inornatus* from *C. neomexicanus* are the smaller size of the former and its complete lack of spots. All the forms here considered are so strikingly differentiated in color pattern that they can be told apart in the field without the necessity of even close observation.

Whereas the spotting of *C. neomexicanus* and that of the sympatric *C. sackii stictogrammus* appears superficially similar, on close inspection many differences in the nature of the spotting become apparent. Among the spotting characteristics of *C. neomexicanus* which make it markedly distinct from *C. sackii* the following are notable: (1) spots diffuse rather than sharply cut-lined; (2) spots lighter yellow in color and duller; (3) fewer spots in each field; (4) spots arranged in a single longitudinal row in the center of the field; (5) spots larger, ca. 1 mm. in diameter in adults; (6) spots lacking on the neck, tail, and in the middorsal (paravertebral) fields; (7) spots confined to the dark fields and nowhere overlying the stripes. Interspecific variation in abundance and distribution of spotting is shown in Table 2.

The presence of seven primary light stripes and blue tails distinguishes both *C. neomexicanus* and *C. inornatus*<sup>5</sup> from *C. sackii stictogrammus*. There is a notable difference in the nature of the color gradient of each light stripe in *C. neomexicanus* and that of the other members of the *sexlineatus* group, in-

<sup>5</sup>In *C. inornatus* at some localities, the central (vertebral) stripe is obscured or lacking, especially posteriorly.

**Table 2. Number of light spots in dark fields of *C. neomexicanus* and *C. sackii* from Socorro County, New Mexico.**

Species		Spots per dark field							Mean
	Specimen number	Left lower lateral	Left upper lateral	Left dorso-lateral	Paravertebrals or Middorsal	Right dorso-lateral	Right upper lateral	Right lower lateral	
<i>C. neomexicanus</i> (5 specimens)	1	0	18	9	0	11	17	0	
	2	0	17	12	0	14	16	0	
	3	0	19	15	0	15	19	0	
	4	0	15	12	0	13	17	0	
	5	0	18	13	0	12	16	0	
		0	15-19 (17.4)	9-15 (12.2)	0	11-15 (13.0)	16-19 (17.0)	0	59.6
<i>C. sackii</i> (3 specimens)	1	11	31	34	9	27	29	13	
	2	16	34	28	12	29	37	15	
	3	14	36	31	7	30	36	17	
		11-16 (13.7)	31-36 (33.7)	28-34 (31.0)	7-12 (9.3)	27-30 (28.7)	29-37 (34.0)	13-17 (15.0)	165.4

cluding *C. sackii* and *C. inornatus*. In every age group of the latter forms, the individual stripes are markedly more yellowish anteriorly and grade into duller yellowish and brownish posteriorly, whereas in *C. neomexicanus* each stripe is relatively uniform, being barely different in color anteroposteriorly. Table 4 presents comparisons of the general color patterns of the three species based on specimens from Socorro County, New Mexico.

**Table 3. Scale counts for *C. neomexicanus*, *C. sackii* and *C. inornatus*.**

All specimens from Socorro County, New Mexico. O-R—occiput to rump; around--around midbody, excepting ventrals; P-V—between paravertebral stripes. Data graphed in Figure 3.

Characteristic	N	<i>neomexicanus</i>	N	<i>sackii</i>	N	<i>inornatus</i>
Scales O-R	19	184.3±1.2 (178-198)	11	178.5± 1.6 (171-185)	20	153.7±2.0 (141-173)
Scales around	20	74.9±0.62 (71-80)	11	68.7±1.2 (62-71)	20	62.0±0.69 (55-78)
Scales P-V	20	10.2±0.28 (9-13)	10	4.5±0.22 (4-6)	20	8.6±0.28 (7-11)

**Table 4. Characteristics of color pattern, *C. inornatus*, *C. sackii* and *C. neomexicanus* at type locality of *neomexicanus*, Socorro County, New Mexico.**

Characteristic	<i>neomexicanus</i>	<i>sackii</i>	<i>inornatus</i>
Ground color			
dorsal, head	light brown	brown	dark brown
dorsal, midbody	black to blackish brown	brown	dark brown
dorsal, tail, distal	light blue	tan or light olive brown	blue
ventral	faint blue	very faint bluish	markedly light blue
Light stripes			
vertebral, midbody	<i>present</i> ; bold, occasionally serrate, very distinct like remainder of stripes	<i>absent</i> (beyond a trace on nape)	<i>present or absent</i> : if present, relatively less distinct than remainder of stripes
paravertebrals, midbody	dull yellowish-brown	bright yellow	yellow to yellowish
Spots at midbody	<i>present</i> ; dull yellowish brown	<i>present</i> ; yellow	<i>absent</i>
Iris	green	yellow to greenish yellow	olive green

Table 3 and Figure 3 present comparisons of scale row characteristics of *C. neomexicanus* with *C. sackii* and *C. inornatus*. In the characteristics of post-antebrachials, *C. neomexicanus* is closer to *C. inornatus* than to *C. sackii* as both of the former lack the abruptly enlarged scales found in the latter. The smaller and less abruptly enlarged mesoptychials of *C. neomexicanus* set it apart from both *C. sackii* and *C. inornatus*. The high degree of development



of circumorbital semicircles sets *C. neomexicanus* off from all other members of the *sexlineatus* group (Fig. 1).

It may be said that in many respects *C. neomexicanus* is intermediate in color pattern between *C. sackii* and *C. inornatus*, but this is not similarly true for scalation. In totality of morphological characteristics, *C. neomexicanus* is

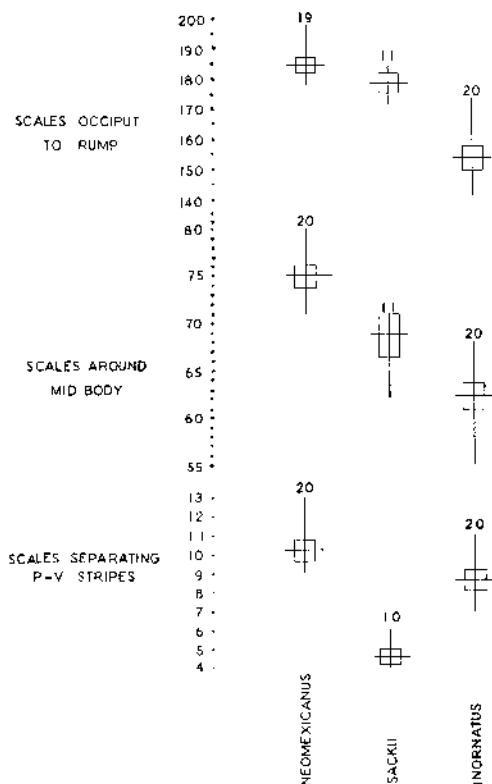


Figure 3. Characteristics of scalation in three species of *Cnemidophorus*, based on specimens from Socorro County, New Mexico. The vertical line represents the range, the horizontal the mean. The rectangles enclose two standard errors of the mean; thus if the rectangles for two sets of data do not overlap, the difference between their means is considered statistically significant.

perhaps closer to the non-spotted *C. inornatus* than it is to *C. sackii*, irrespective of the superficial resemblance due to spotting in both *C. sackii* and *C. neomexicanus*. Diagnostic differences between *C. neomexicanus* and the remaining species in the *sexlineatus* group are given on page 230.

*Ecology.* A brief discussion is included here to indicate the nature of the major habitat types at, and in the vicinity of, the type locality, and the relative population densities of the sympatric species of *Cnemidophorus* occurring during the period of observation, 1947-1950.

The type locality (Plate 1) is at an elevation of 4800 feet in a transitional (ecotone) area bordering an *Atriplex canescens*-*Sporobolus airoides* playa immediately to the west and a *Yucca elata*-*Aristida adscensionis*-*Bouteloua barbata* grassland on a sandy, gentle alluvial slope to the east. The locality is on the Jornada del Muerto near the western foot of the north-south oriented San Andreas Mountain range. Of the five species of *Cnemidophorus* occurring sympatrically here (which, as stated above, is the total number of species presently known to occur in the state of New Mexico), *C. neomexicanus* is by far the most abundant and *C. sackii* the least abundant. The latter eurytopic form is more typical not necessarily of higher elevations so much as "higher" vegetation zones and often occurs abundantly, and with *C. inornatus*, in juniper-grassland and pinon-juniper woodland; in New Mexico it occurs to well over 7000 feet elevation in yellow pine. At the type locality of *C. neomexicanus* it does not occur on the saltbush-sacaton playa itself whereas *C. neomexicanus* is common there. *C. tigris* and *C. inornatus* are common at the type locality but *C. tessellatus* like *C. sackii* is not nearly as abundant as the others. Rather, *C. tessellatus* is marginal in its existence here, being common to surrounding higher zones (and different edaphic conditions) but not those as cool and mesic as favored by *C. sackii*. In an area of *Yucca*-grassland and "grassland" about ten miles north of the type locality of *C. neomexicanus*, *C. tessellatus* occurs to the apparent complete exclusion of *C. tigris*. While *C. tigris* occurs on the playa proper along with *C. inornatus* and *C. neomexicanus*, it is not as commonly observed there as are the latter two. Both *C. tigris* and *C. inornatus*, but not *C. neomexicanus*, are commonly observed in the surrounding yucca-grassland bordering the saltbush-sacaton playa. While *C. neomexicanus* is rarely found up in the extensive yucca-grassland bordering the type locality, on the other hand it is the commonest lizard in the saltbush-sacaton habitat.

Another locality at which all five New Mexican species were observed together was on the outskirts of the town of Socorro, in a sandy, rocky wash in which creosote bush, *Larrea divericata*, was the dominant plant. Here *C. tigris* was the most prominent *Cnemidophorus*, with the other four species much less abundant. A short distance away, on the Jornada del Muerto, where Russian-thistle (*Salsola kali*, an early or pioneer successional element) existed in almost pure stands on sandy soil, *C. inornatus* was very abundant with all other species far less abundant.

Obviously much intensive work will be necessary before the complex ecologic relationships of the whiptailed lizards of New Mexico and the Southwest in general can be stated with a good degree of assurance. Although little is known of the extent of either its true geographic or ecologic distribution, from observations at the type locality and at the few additional localities in which it is known to occur, it is indicated that *C. neomexicanus* is primarily a bottom land dweller that is to be found either infrequently or not at all in yucca-grass, oak, juniper, or pinon dominated habitats at this latitude (Fig. 4).

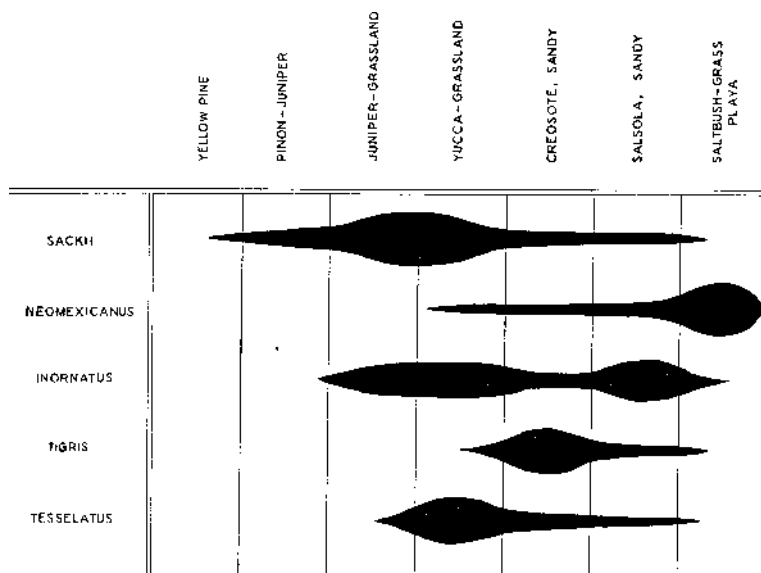


Figure 4. Tentative suggestion of ecologic distributions of the species of *Cnemidophorus* occurring in south-central New Mexico, based on four years field observations during summer months, 1947-1950.

*Amphibians and reptiles of the type locality.* As an appendix to the ecological discussion, we offer the following list of amphibians and reptiles col-

lected at the type locality of *C. neomexicanus* (1947-1950):

*Ambystoma tigrinum mavortium*  
*Scaphiopus bombrifrons*  
*Scaphiopus hammondi hammondi*  
*Scaphiopus couchii*  
*Bufo cognatus*  
*Bufo debilis insidiosus*  
*Crotaphytus wislizenii wislizenii*  
*Holbrookia maculata approximans*  
*Phrynosoma cornutum*  
*Phrynosoma modestum*  
*Sceloporus undulatus consobrinus*  
*Uta stansburiana stejnegeri*

*Cnemidophorus sackii*  
*stictogrammus*  
*Cnemidophorus inornatus*  
*Cnemidophorus tigris maculatus*  
*Cnemidophorus tessellatus*  
*Cnemidophorus neomexicanus*  
*Heterodon nasicus kennedyi*  
*Rhinocheilus lecontei tessellatus*  
*Arizona elegans philipi*  
*Lampropeltis getulus splendida*  
*Pituophis melanoleucus affinis*  
*Masticophis flagellum*  
*Crotalus viridis viridis*